MULTIMEDIA UNIVERSITY

STUDENT ID NO

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# MULTIMEDIA UNIVERSITY

# FINAL EXAMINATION

**TRIMESTER 1, 2018/2019**

## PES0024 – ESSENTIAL STATISTICS

( All sections / Groups )

23 OCTOBER 2018
2.30 p.m – 4.30 p.m
( 2 Hours )

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**INSTRUCTIONS TO STUDENT**

1. This Question paper consists of **6 pages** including cover page and mathematical formulas with **4 Questions** only.

2. Attempt **ALL** questions and write your answers in the Answer Booklet provided.

3. The candidate is allowed to use scientific calculators that are permitted to be used in the examination.

**Question 1 (20 marks)**

a. Classify each variable as quantitative or qualitative. **(5 marks)**

i. Number of doors in a house.

ii. Favourite place to travel.

iii. Colour of outfits in the wardrobe.

iv. The length of time taken to travel from MMU Cyberjaya campus to Melaka campus.

v. Name of films released in the past 5 months.

b. The following table shows the favourite movie genre preferred by 30 randomly chosen students in MMU. The responses are as follows, where Ac, Co, Ho, Ro and Th denote Action, Comedy, Horror, Romance and Thriller, respectively.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Ac | Ho | Ro | Th | Co | Ho | Ro | Ac | Ho | Ac |
| Ro | Co | Ac | Ac | Ho | Co | Ac | Th | Ho | Ac |
| Ac | Th | Ho | Ho | Ac | Co | Ac | Ho | Th | Co |

Construct a distribution table, which include frequency, relative frequency and percentage for each category. **(4 marks)**

c. The table below shows a sample of weight for 50 students in MMU.

| Weight (kg) | Number of students | Midpoint, $m$ | $m^2$ | $mf$ | $m^2f$ |
|---|---|---|---|---|---|
| 40 – 49 | 5 | | | | |
| 50 – 59 | 20 | | | | |
| 60 – 69 | 13 | | | | |
| 70 – 79 | 9 | | | | |
| 80 – 89 | 3 | | | | |
| | | | | $\sum mf =$ | $\sum m^2 f =$ |

From the above information,

i. copy the table and complete it in the answer booklet provided. **(5 marks)**

ii. calculate the sample mean. **(2 marks)**

iii. find the sample standard deviation. **(4 marks)**

**Continued...**

**Question 2 (30 marks)**

a. The following probability distribution recorded the number of hours a person spent for sleeping at night.

| Number of hours, $x$ | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|
| P $(X=x)$ | 0.08 | 0.27 | 0.35 | $y$ | 0.15 |

i. Find $P(7 \le X \le 9)$. **(3 marks)**

ii. Find the variance of this distribution. **(4 marks)**

b. In a survey conducted, it is found that 35% of students exercise everyday. If a sample of 12 students are selected at random, find the probability that

i. at least 4 students exercise everyday. **(3 marks)**

ii. less than 8 students exercise everyday. **(2 marks)**

c. The average number of cars sold by the Luxurious Automobile is two cars per day. Calculate the probability that

i. exactly 3 cars will be sold in a day. **(3 marks)**

ii. more than 5 cars will be sold in 2 days. **(4 marks)**

d. A company pays the employees an average of \$35 an hour with a standard deviation of \$2.50. If the wages are approximately normally distributed, find the probability that the employees receive wages

i. more than \$29.50. **(3 marks)**

ii. less than \$35.80. **(3 marks)**

iii. between \$32.20 to \$36. **(5 marks)**

**Question 3 (25 marks)**

a. Suppose there are only 5 students in the Essential Statistics class. The test results for the 5 students who we will call as A, B, C, D and E are shown in the table below:

| **Student** | A | B | C | D | E |
|---|---|---|---|---|---|
| **Test result** | 75 | 82 | 80 | 94 | 81 |

i. Find the population mean and standard deviation. **(5 marks)**

ii. List all possible samples of three selected students (without replacement) and construct the sampling distribution of the sample mean. **(9 marks)**

iii. Calculate the sampling error. **(2 marks)**

b. The amount of time that a telemarketer spends on a customer follow a normal distribution with mean of 5.4 minutes and a standard deviation of 1.2 minutes. If a random sample of 18 customers is observed, find the probability that the mean time of this sample is

i. less than 4.5 minutes. **(4 marks)**

ii. between 5.5 to 6.1 minutes. **(5 marks)**

**Continued...**

**Question 4 (25 marks)**

a. A survey by a water supply company has been done to identify the average bill payment that has been paid by their customers. The bill payment is normally distributed with a standard deviation $\sigma = \text{RM}3.5$. A random sample of bill payment for 16 customers are given below:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 16 | 10 | 13.5 | 22 | 12.8 | 19 | 24.2 | 15 |
| 26.5 | 24 | 18.8 | 30 | 27 | 22 | 16 | 15.2 |

i. What is the point estimate of the population mean? **(3 marks)**

ii. Find $\mu_{\bar{x}}$ and $\sigma_{\bar{x}}$. **(3 marks)**

iii. Construct a 97% confidence interval for the mean bill payment. **(6 marks)**

b. A machine is being used for packaging chocolate bar. It is known that the standard deviation of the net weight of all chocolate bar is 0.65g. A quality engineer selects a sample of 50 packages during the production process and gets a mean net weight of 82g.

i. What is the point estimate of the population mean? **(1 mark)**

ii. Calculate the margin of error of point estimation. **(3 marks)**

iii. Find a 90% confidence interval for the corresponding population mean. **(6 marks)**

iv. State three factors that can affect the width of confidence interval. **(3 marks)**

**End of Page.**

# APPENDIX – KEY FORMULAE

## Measures of Central of Tendency and Measures of Dispersion

| SAMPLE | Ungrouped Data | Grouped Data |
|---|---|---|
| **Mean** | $\bar{x} = \frac{\sum x}{n}$ | $\bar{x} = \frac{\sum mf}{n}$ <br> Where $m$ = midpoint, $n = \sum f$ |
| **Variance** | $s^2 = \frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1}$ | $s^2 = \frac{\sum m^2 f - \frac{(\sum mf)^2}{n}}{n-1}$ |
| **Standard deviation** | $s = \sqrt{s^2}$ | $s = \sqrt{s^2}$ |

| POPULATION | Ungrouped Data | Grouped Data |
|---|---|---|
| **Mean** | $\mu = \frac{\sum x}{N}$ | $\mu = \frac{\sum mf}{N}$ |
| **Variance** | $\sigma^2 = \frac{\sum x^2 - \frac{(\sum x)^2}{N}}{N}$ | $\sigma^2 = \frac{\sum m^2 f - \frac{(\sum mf)^2}{N}}{N}$ |

## Discrete Random Variable

| **Mean:** | **Variance:** |
|---|---|
| $\mu = E(X) = \sum xP(X = x)$ | $\sigma^2 = E(X^2) - [E(X)]^2$ <br> where $E(X^2) = \sum x^2 P(X = x)$ |

## Binomial Distribution

| Binomial probability formula: | $P(X = x) = \binom{n}{x} p^x q^{n-x}$ |
|---|---|

Key formula for Binomial Probability Distribution

If $p \leq 0.5$,

i. $P(X = r) = B(r) - B(r-1)$

ii. $P(X \geq r) = 1 - B(r-1)$

iii. $P(X \leq r) = B(r)$

iv. $P(X > r) = 1 - B(r)$

v. $P(X < r) = B(r-1)$

vi. $P(a \leq X \leq b) = B(b) - B(a-1)$

| | | |
|---|---|---|
| If $p > 0.5$ | i. | $P(X = r) = B(n-r) - B(n-r-1)$ |
| | ii. | $P(X \geq r) = B(n-r)$ |
| | iii. | $P(X \leq r) = 1 - B(n-r-1)$ |
| | iv. | $P(X > r) = B(n-r-1)$ |
| | v. | $P(X < r) = 1 - B(n-r)$ |
| | vi. | $P(a \leq X \leq b) = B(n-a) - B(n-b-1)$ |

**Poisson Distribution**

| | |
|---|---|
| Poisson probability formula: | $P(X = x) = \dfrac{e^{-\lambda}\lambda^{x}}{x!}$ |

Key formula for Poisson Probability Distribution:

| | | |
|---|---|---|
| If $\mu = \lambda$, | i. | $P(X = r) = Poi(r) - Poi(r-1)$ |
| | ii. | $P(X \geq r) = 1 - Poi(r-1)$ |
| | iii. | $P(X \leq r) = Poi(r)$ |
| | iv. | $P(X > r) = 1 - Poi(r)$ |
| | v. | $P(X < r) = Poi(r-1)$ |
| | vi. | $P(a \leq X \leq b) = Poi(b) - Poi(a-1)$ |

**Normal Probability Distribution**

$z$-value: $Z = \dfrac{x - \mu}{\sigma}$

**Sampling Distribution**

$z$-value: $Z = \dfrac{\bar{x} - \mu}{\dfrac{\sigma}{\sqrt{n}}}$

**Estimation**

Confidence interval: $\bar{x} \pm z_{\alpha/2}\left(\dfrac{\sigma}{\sqrt{n}}\right)$